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ABSTRACT

Although schools have made a slight change from slate and chalk to books and pens, the underlying social organization of many still rests on assumptions that act as barriers to such innovations as computer based education (CBE). Good planning and careful control can raise the probability of successful integration of innovation into the culture, and Niehoff (1966) has proposed a model for planned change that could easily be applied to the implementation of CBE. Attention should be paid to two major forces affecting planned innovation: techniques used by the innovator to achieve adoption of an innovation, and behavior of the recipients toward the proposed innovation. Six forces affecting directed change are methods of communication, participation of the recipients, utilization of established practices, felt need of recipients, perceived benefits of the innovation, and involvement in local leadership. If initial success is obtained with the implementation plan, some secondary factors must be taken into account, such as flexibility of the innovator, provisions for continuity and maintenance, and training for school personnel. (VT)

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ELECTRONIC COMPUTERS FOR SLATE-BOARD SCHOOLS: AN ETHNOGRAPHIC PARALLEL TO STEEL AXES FOR STONE-AGE MEN

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

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Where will education be in 1984? Education is presently frozen in the technology of the past. However, a 1972 Carnegie Commission Report suggests that the education industry is currently sitting on the brink of its first technological revolution in five centuries--the revolution of the new electronics. According to this report, three major revolutions in education have already taken place.

The first revolution in education was ushered in with the introduction and adaptation of the written word; the second was the use of textbooks that followed the invention of moveable type. The third revolution came about as a result of industrialization and centered on the implementation of universal public education. Today, we are attempting to attain the goal of customizing education to individual needs on a universal basis, e.g., laws on "mainstreaming." The fourth revolution can facilitate this goal by introducing modern technology associated with electronic communication systems and electronic data processing systems.

Currently, however, few educational institutions have availed themselves of this opportunity. A Federal Commission on Instructional Technology reported that the impact of technology upon American education in 1969 was no greater than the impact the automobile had made on American life before the Model T (Cunningham, 1977). This paper has attempted to deal with general concepts of planned culture change that could reduce the education industry's resistance to technological change. Ethnographic parallels were utilized to demonstrate the desirable use of the principles of culture change and technological innovation in the culture of our schools.

Education as a Culture

The school, and professional education in general, can be viewed as a unique culture with its own defined field of ethnology. Therefore, the success of a deliberate introduction of radically new technology into this culture will depend, to a large extent, upon a full understanding and consideration of that ethnology. Innovators interested in promoting computer based education systems within the education culture may be more successful if they avail themselves of the principles of planned culture change generated by applied anthropology.

Kroeber (1963, p. 94) states that ". . . most of what is in any culture was produced outside of it . . ." Stiles and Robinson (1973) add that change in education is typically generated from outside rather than from within. Moreover, anthropologists have shown that technical know-how is imbedded in cultural systems; and that patterns of beliefs and behavior that make up such systems can act as either

sanctions or barriers to technological change (Niehoff, 1966). A rather dramatic example of how changes in technology can have devastating effects upon the social system is provided by a study of the Yir Yoront, a tribe of Australian aborigines (Sharp, 1952).

The Cultural Significance of a Tool

The Yir Yoront lived in almost total isolation from Western culture until the early 1900's. A stone-age technology existed. Only adult males could make and own axes. Stone for the ax heads was not available near the coast. Therefore, an elaborate trading system was established with inland tribes many miles to the south. Stingray spears made near the coast were taken south and stone ax heads were brought north. Each male Yir Yoront developed trading partners with members of the inland tribes. Most exchanges took place during very large inter-tribal meetings that were attended by hundreds of men from many tribes. Various initiation and totemic ceremonies provided a festive atmosphere at each of these meetings; but the trading of spears for stone ax heads was an important part of the motivation for the inter-tribal meetings.

For the Yir Yoront, the ax was a symbol of masculinity, status and authority. The ax was held in such high regard because all members of the tribe, men, women, and children, had to use the axes in their daily tasks. The women and children, however, were required to borrow their axes from the men. The borrowing followed kinship lines and established the male head of the family as the dominant figure. This practice defined and maintained a deeply imbedded system of status, sex and role inequality. The ritual established by this custom maintained the status quo for the Yir Yoront and provided an era of stability that this culture enjoyed for hundreds of years. That stability was shattered by the arrival of missionaries who brought with them the tools and cultural ideas of a new age.

One of the tools that the missionaries brought with them was the steel ax. However, the distribution of the steel axes by the missionaries was done indiscriminantly. Women and children ended up owning most of the steel axes. This meant that an adult male who wanted a steel ax had to borrow it from a women or a child or had to obtain his own steel ax from the missionaries. Unfortunately for the male Yir Yoront, steel ax giving at the mission was done rather capriciously. This condition strained traditional sex, age and kinship roles; it blurred leadership patterns, weakened traditional trading practices, and reduced attendance at inter-tribal ceremonies.

The steel ax also affected the Yir Yoront belief system. This was inevitable since every element of their culture was accompanied by a myth which explained its existence. No one could concoct an acceptable myth about the steel ax. Therefore, since the steel ax

couldn't be made to fit into the tribe's totem, doubt and confusion developed over other aspects of the belief system. This confusion, combined with other impositions introduced by the Westerners, forced the Yir Yoront into a set of conditions under which the stone-age culture could not long survive.

The Cultural Significance of Computers in the Classroom

We are not interested in providing steel axes for stone-age men. We are interested, however, in providing electronic computers for schools whose technological development may have been arrested at the slate-board stage. Schools have made a slight change from slate and chalk to books and pens, but the underlying social organization of many schools rests on assumptions that act as barriers to the introduction of computer based education. As in the case of the Yir Yoront men, most present-day classroom teachers who want the new technology, educational computing, must exchange their old technology of lesson preparation and delivery for a new method. The old technology provides independence, self-sufficiency and autonomy. The new technology tends to make the teacher dependent and subordinate to computer operators, programmers, and machines; technologists advise teachers as to what can or is currently being done and what is the next most probable instructional move. Indirectly, the teachers of computer-taught students are asked to relinquish old myths about teachers and teaching (Allen, 1971; Stiles and Robinson, 1973, p. 265). Teachers in slate-board schools were dispensers of information and drill masters. These are still the dominant images when one is asked to think of teaching. For most people, images of teaching involve the teacher lecturing to or interacting with students. Consider, also, which teachers have tended to receive the most recognition: the charismatic performer; the loveable mother figure, the exciting group organizer. Each type is secure in the knowledge that the role he plays is certain to bring him success. An innovation such as educational computing raises questions about established myths concerning the role of teachers. It should be no surprise that many school personnel believe that computers may be good for other students but not for their own.

Patterns of behavior which have paid off in the past are going to be maintained until expectations of better payoffs have been envisioned (Nordskog, 1960). Even if the new technology is accepted, it may only be used for the same old things or be reduced to doing tasks that are mirror images of ancient practices. For example, it is interesting to note that the steel ax was used only for those tasks for which the stone ax had been used. The Yir Yoront's savings in time and effort were spent sleeping. Currently, educators have utilized the savings in instructional time that educational television has provided in a similar manner. Consider how television originally was used by the education industry; it was perceive as a way to permit the "master teacher" to lecture to many more students

than was previously possible through live sessions. Television presentations permitted the regular classroom teacher to maintain discipline, take a coffee break, or, as did the Yir Yoront, sleep. Thus, the achievement gains realized through instructional television were minimal. In addition, the development of instructional technology was minimal. For example, think of how television was used to do what previously had been impossible or very difficult to accomplish in a regular classroom with traditional equipment. Very few examples come to mind. We can cite:

1. feedback for various performances in the arts,
2. feedback for athletics,
3. microteaching, and
4. views of ongoing surgery and other detail activities where a lens can zoom in for close-ups.

Unfortunately, the above types of applications are the uncommon uses of instructional television. The paucity of this kind of use indicates that established practices and assumptions about teaching and learning common in the education culture have inhibited and thwarted the diffusion of technological innovation (Kroeber, 1963, p. 223). Innovation based upon computer technology could suffer the same fate.

A humorous but sad tale is told of a group of Southeast Asian villagers who were given powdered milk to help solve their nutrition problem. "The villagers who had never used milk before reportedly used the powdered milk to make lines on their soccer fields" (Niehoff, 1966). It appears that consideration had been given only to the physical distribution of the new technology, i.e., powdered milk. Little, if any, consideration had been given to the cultural factors involved. A social-cultural approach to planned cultural change would alert one not only to the probability and source of resistance, but also to the modifications that might occur as a result of acculturation (Kroeber, 1963; DuBois, 1961).

A Social-Cultural Model for Planned Change

Deliberate social change involves a plan, a procedure for moving from an existing way of doing things to the integration of a new idea or technique. As part of the plan, one must identify the major forces that impinge upon the innovation. Niehoff (1966) has suggested that planned innovation has only two major forces which act upon it. The first force comprises the techniques used by the innovator to achieve adoption of an innovation. The second force includes the behavior of the recipients toward the proposed innovation.

Fortunately, the techniques of the innovator appear to have far more influence upon the success of an innovation than do the characteristics of the recipients. This means that good planning and careful control can raise the probability of successful integration of

an innovation into the culture. However, it will be necessary to give attention to the several factors that comprise these two major forces affecting planned innovation.

Niehoff has identified seventeen kinds of factors which impinge upon the implementation of an innovation. Six of the factors appear to be primary process variables, and we have separated them into characteristics of the innovator and characteristics of the recipients of the innovation.

First, the characteristics of the innovator:

1. the methods of communication used by the innovator;

2. the type of participation the innovator obtains from the recipients; and

3. the manner in which the innovator utilizes local culture and adapts the innovation to existing cultural patterns.

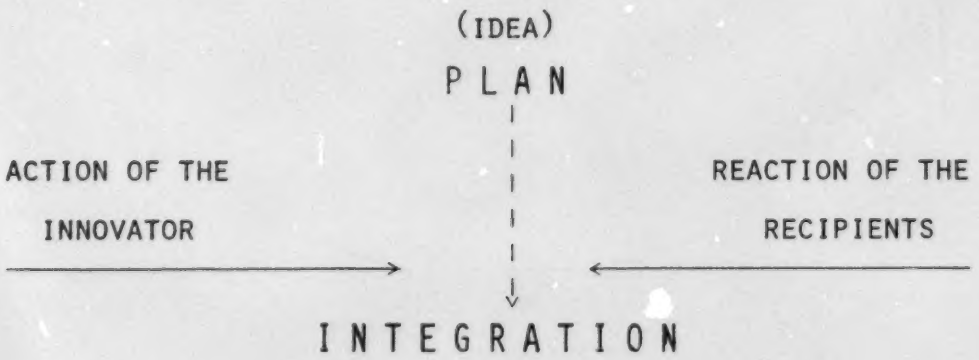
Second, the characteristics of the recipients:

1. whether or not the recipients have an initial felt need;

2. whether the recipients perceive any practical benefit in adopting a change; and

3. whether the recipients' traditional leaders are brought into the planning and implementation of the process.

The reader may find that other models of planned change are more appropriate for his own particular problem. Many have been offered (Schaller, 1972; Bennis, Benne and Chin, 1961). Niehoff's was selected as a guide for our discussion. His analysis of anthropological studies indicates that almost all of the successful change projects accounted for all of the characteristics listed above in the innovation plan. The following model (Niehoff, 1966, p. 11) may be of some use in conceptualizing these factors.



Methods of Communication

The application of Niehoff's model to the implementation of computer based education (CBE) is rather obvious. For example, in the area of communication, the use of demonstration, personal contact, and feedback are quite important.

Initially, an effective demonstration of an innovation such as CBE can provide immediate and dramatic proof of the efficacy of the proposal. Perhaps the innovator should arrange for educators (the recipients) to learn about CBE via CBE rather than by means of lectures and films.

Secondly, personal interaction with those who must adopt the innovation puts the innovator into the social system of the school, and, therefore, must be part of the innovator's plan. Personal interaction permits teachers and administrators to raise questions and express feelings that might not be communicated openly in large formal groups. One of the authors has found that parties held off the school grounds in "neutral" quarters creates an environment that promotes honest communication. At such times, school personnel have confided privately their personal fears as well as their favorable inclinations. These feelings would never have been expressed in a more formal setting.

A third concern of utmost importance is the establishment of a feedback channel. In the case of many innovations, this is difficult to achieve. Fortunately, feedback is a built in part of a CBE system and is not an unfamiliar idea to the computer specialist. However, feedback is also critical in its social sense if the innovator is to know how the school personnel are reacting to CBE. It is by means of this feedback that the progress of the innovation plan can be assessed. Parties, computer messages, personal visits, committee reports are all possibilities. Feedback helps one maintain the use of local language and reduces unnecessary use of technical jargon. One of the authors found that a teacher's guide for an elementary math program was not being read adequately. One section was entitled, "Control Functions." When this was changed to "Teacher Control of Instruction," it was read, and the teachers were much more satisfied with the program.

Participation of the Recipients

If school personnel, this includes administrators as well as faculty, do not participate in the CBE innovation plan, it is unlikely that they will continue with CBE after the innovator leaves. Participation by the recipients is a basic index of their commitment. Barth (1967) insists that the allocation of time and resources is the critical variable. Decisions about the allocation of time, labor, money, physical resources, and social behaviors such as

deference or ridicule make up the core factor associated with social or institutional change. Innovators should work toward gaining this kind of behavioral commitment. Both teachers and administrators must begin to allot time and resources to CBE.

One of the authors has been conducting a very intensive two-week summer workshop on CBE. Apparently, involvement in this workshop has contributed significantly to developing a commitment to foster CBE. It was discovered that in the last two or three years twelve school districts in our area had adopted CBE and maintained it a second year. Each of these districts had someone in attendance at one of the workshops. Two districts adopted CBE but did not maintain it a second year. Neither of these districts had any members in attendance at a CBE workshop. We need to discover other techniques for developing commitment that have this degree of success.

Utilization of Established Patterns

Innovators may either attempt to replace inefficient practices in toto or they may attempt to adapt old practices by grafting new practices onto them. Members of a culture, e.g., school personnel, will not willingly give up old practices until they are convinced that the proposed innovations will contribute to an overall gain for them. Complete replacement of a practice is more likely to be resisted than is the adaptation of that practice. Adaptation permits both old and new to compete on relatively equal terms. Replacement will occur automatically if it really does contribute to significant payoff.

For example, it would be almost impossible to have CBE immediately adopted as a complete replacement for classroom, teacher-led instruction. Human interaction, teacher-pupil interaction, will not be completely replaced, nor is it advocated here. The reaction of educators to terms and phrases connoting the replacement of teachers has been quite negative for some time (Tobias, 1966). It is possible, however, to convince teachers that CBE can be used effectively as a supplement to ongoing instruction for the purpose of improving competencies in basic skills or for checking the progress that students are making with classroom materials (Jamison, Suppes and Wells, 1975; Hirschbuhl, K., 1977). Furthermore, by facilitating the organization of small-group instruction, CBE may permit the teacher to play the traditional roles more effectively, i.e., permit the teacher to have more personal contact with the students.

It is interesting to observe and discuss the uncomfortable feelings experienced by many teachers the first time they find students learning without their help. Generally, we have found that teachers are unwilling to give up control of the teaching process to a computer program. They are much more willing to try to utilize CBE when

computer programs permit them to decide specifically what the student will study or practice each day. They want this study tied directly to the instruction they are presenting that day. They are interested in drill and practice material, instructional management programs, and terminals located in their rooms. Sending the student off to some other part of the building is perceived as losing control of the student and his instruction.

Utilizing these and other traditional practices should not be viewed as an undesirable compromise by the computer advocate. Gibson and Nolan (1974) have identified four stages of computer growth in industry. Education is still at the first stage. After the computer has been integrated into instruction by adapting established practices, more effective and original utilization can be attempted with minimal risks. We shall give further consideration to the utilization of traditional practices when we discuss perceived benefits.

Felt Need of the Recipients

One of the most significant forces that impinge upon the recipients in planned change is the extent to which a felt need is present (Barnett, 1953). If a felt need is present, it will serve as a catalyst for motivating a search for a means of satisfying the need. The recipients' motivation may be indicated by the solicitation of help, i.e., a request for outside assistance in solving a local problem. Although this reaction generally indicates the presence of a need, the need may be one of seeking status or "getting on the band-wagon" and may result in short-term adoptions. Such outcomes are almost certain if those who are soliciting help are more interested in the material or prestige benefits brought by the innovator rather than the innovation itself.

One of the clues that innovators can use to determine the presence of a felt need is the extent to which a group has attempted to solve a problem by their own efforts without outside assistance. Recipients who have attempted to do some of the things that CBE is capable of doing more effectively have a strong motivation for change. They know the magnitude of the problem, and they have experienced unsatisfactory results with other techniques. This is a situation in which a CBE innovation is likely to result in a successful adoption.

Not all needs are overt. In some cases they are latent, and a needs assessment study must be conducted. The successful introduction of CBE within an institution may be dependent upon such a study. There is evidence that many educational institutions have common latent needs. National surveys indicate that certain classes of needs persist throughout most of the country (Gallup, 1976; DeCecco and Richards, 1975; Harnischfeger and Wiley, 1976).

Significant concerns of parents and teachers include behavior management, motivation, and achievement in reading, mathematics, and composition. All school adoptions of CBE in our area have occurred because of concern over achievement in reading and mathematics.

CBE hardware and software that draw from and simulate popular types of games, or which are in other ways intrinsically motivating for recalcitrant learners, would fulfill many of the felt needs. Such applications would exemplify the strategy of using established practices, since special techniques and provisions for the exceptional child are very common. Teachers are usually interested in finding ways to handle the exceptions, whether the child is unusually slow, fast, hyperactive, or withdrawn. CBE applications that address these needs may be more readily supported and adopted by teachers than programs designed for average pupils in nonsensitive academic areas.

Perceived Benefits

Once a problem has been identified, the recipients must perceive that 1) there is a sincere intent to solve the problem by means of CBE, 2) CBE is an effective method for solving the problem, and 3) that there is some benefit to the recipients for solving the problem with CBE. It is very important that the benefits the innovator perceives as significant are similar to the benefits the recipients perceive as significant. The perception of the recipients is often influenced by the results of previous attempts to deal with the problem or with innovation generally.

An example of how previous innovation attempts can cause educators to act or fail to act on a proposed innovation is given by Sarason (1971) when he discusses an attempt to gain an innovation's entry into a school. Sarason gave an introductory talk to the entire staff of a school system prior to the opening of school. He observed that this formal mode of communication resulted in negative reactions. It wasn't, however, until he established personal communication and feedback channels that he began to understand the perception of the school personnel.

Sarason concluded that the negative results arose from the following set of conditions. Participants had heard such talks at the beginning of the school year many times before. They reacted with, "Here we go again." The reason for this negative feeling was that services had been promised in the past, but either no one showed up or they came so infrequently that their help was valueless. Evantually, the outsiders who promised to help disappeared. It is not suprising that the innovators were "perceived as transients on whom one could not or should not depend." Sarason also discovered that the principals and older teachers resented the "outsiders." They believed that the administration respected and supported the

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outsiders to a greater extent than the insiders. Proposals originating from within rarely ever got to the discussion stage and were almost never implemented. In a more formal manner, Sarason hypothesizes that the ratio of proposals made to those implemented within an organization is a good indication of what will happen to new proposals in that organization. Thus, the success of an innovation originating from without appears to be a function of the success of previous attempts to innovate from within. This characteristic of a school or system may provide CBE innovators with a good measure of where their efforts have a fair chance of paying off.

The Sarason report represents the situation where the innovation is ignored because of perceived expectations. In other cases, the innovation might be opposed because of perceived threats. In a successful innovation plan, benefits of CBE can range from enhancement of one's career, convenience, novelty, self-improvement, status change, mental health, improvement in student behavior to student achievement. These perceived benefits must be weighed against perceived costs. The risk involved in disrupting survival techniques of school personnel must be taken into account by the innovator. Insecurity arising from budgets, community concerns, competition, or student discipline will reduce the recipients willingness to take chances. As we have mentioned earlier, teachers resent the idea of being replaced. They also resist changes that diminish their importance or alter their roles. Factors such as these will vary. Careful study of a particular school or system and the nurturance of open communication with the innovator should increase the likelihood of a successful CBE implementation plan. The plan should include a well-defined list of benefits that the recipients can compare to their perceived costs and risks. The plan should also include some systematic way of demonstrating progress or lack of progress during the implementation period.

Involvement in Local Leadership

The sixth major force affecting directed change is local leadership. If an innovator ignores the traditional leaders or chooses to associate with the wrong leaders, the chances for implementing CBE are quite small. As is the case in other social systems, educational leaders usually have strong vested interests in their jobs. Outsiders who propose change without securing prior approval are bound to be perceived as threats. There may be times when such influential leaders must be opposed; but they can never be ignored.

The traditional influence of board members, superintendents, and principals is easily recognized. Innovators should also consider the influence of resource teachers, supervisors, and union leaders who work with the classroom teachers on a day-to-day basis. If these persons have the confidence of the teachers, then they also must become supportive of the project.

It is generally conceded that the support of top administrative leadership is absolutely essential if educational innovations are going to be given a fair trial at lower levels of authority (Tope, 1965). Ashby (1974; Carnegie Commission, 1972) believes that utilization of the new technology by the top academic administrators is essential. He believes that the greatest single obstacle to higher education's acceptance of a leadership role in the implementation of CBE is the lack of institutional commitment. The responsibility for reversing this trend lies with the highest level academic officers and administrators. It may not be sufficient for them to give approval; it may be vastly more beneficial for the recognized leaders to employ various aspects of CBE within their own professional assignment. When administrators use CBE as part of their job support system, the faculty should be far more willing to accept CBE support in other areas. Without such an example being set by the leaders, faculty may become suspicious about the institution's commitment. Such suspicion is likely to leave only a few brave souls working for adequate implementation.

Innovators should not neglect the public. It is generally the case that education adopts changes only when public opinion and pressure cannot be ignored. ". . . change in education always is more political than professional, more impromptu than rationally derived . . ." (Stiles and Robinson, 1973). One of the authors arranged for a CBE demonstration which involved the assistant superintendent, principal, teachers, and parents. This resulted in the building principal and some faculty participating in the two-week summer workshop mentioned earlier. The progress of CBE in this school is better than in any other using our computer facilities. Here is an example of public, top administration, and principal support and involvement. Commitment and communication has been excellent. It is interesting to note that the assistant superintendent has recently retired. The new assistant is not as supportive and decreased interest and involvement is being noticed in the school. There is little doubt that the involvement of top academic leadership is essential.

Secondary Considerations

If initial success is obtained with the implementation plan, then some secondary factors must be taken into account. The innovator must be flexible. In order to deal with problems as they arise, a change agent must be able and willing to adjust plans in order to compensate for the unexpected. As the implementation progresses, the innovator should become more familiar with the school and should be able to customize the CBE application. The need for adequate communication and feedback mentioned earlier is essential to this fine tuning (Hirschbuhl, J., 1977).

The innovator must provide for continuity and maintenance. Personnel in the schools must feel comfortable about predicting what the innovator will do. Long-range plans, projections, and short-range target dates permit staff and line personnel to feel relatively secure when local plans are drawn.

The success of the CBE workshop, mentioned earlier, suggests the need for short periods of hands-on experience for all those involved. It also suggests the desirability of half-time internships that permit interested school personnel to work in and assist with the management of a CBE center. They would study the utilization of CBE by students, authors, and supervisors. Such internships would return personnel to the schools with the commitment and training required to maintain and develop instructional computing. These secondary factors would help integrate CBE into the institution's ongoing activities. They would help develop both a technical and organizational pattern that could support and maintain a CBE facility after the innovator leaves.

Summary

In the opening paragraph of this paper, it was stated that education is frozen in the technology of the past. It was suggested that the technological development and the social-cultural condition may be comparable to that of the old slate-board school. This condition was hypothesized as being at least partially the result of inadequately developed innovation plans.

One possible technique for improving the development of innovation plans is to assemble a set of case histories. Each case history would entail a careful analysis of the factors and procedures that influenced the successful or unsuccessful implementation of CBE in some educational institution. CBE innovators may profit, and education in general may profit, from the development of a collection of case studies that center on the implementation of educational computing. It would help satisfy the need for CBE implementation plans to be based upon what can be learned from prior efforts.

It appears that the times and events are such that the widespread implementation of CBE could be imminent. The question as to how long education will continue to sit on the brink of this breakthrough will be determined in part by the readiness of CBE innovators to act effectively within the education culture. It may well be that their effectiveness will be determined by the degree to which they are able to utilize the sociological and anthropological strategies that have been developed in the study of cultural change. Perhaps this is one of the keys to thawing the present technological freeze and unleashing education's "fourth revolution."

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